Pediatric tracheotomy: 3-year experience at a tertiary care center with 54 children

Sinan Atmaca[1], Cem Bayraktar[1], Nazik Aşılıoğlu[2], Gökhan Kalkan[2], Zeki Özsoy[1]

1Department of Otolaryngology and Head and Neck Surgery and 2Pediatric Intensive Care Unit, Department of Pediatrics, Ondokuz Mayıs University Faculty of Medicine, Samsun, Turkey

SUMMARY: Atmaca S, Bayraktar C, Aşılıoğlu N, Kalkan G, Özsoy Z. Pediatric tracheotomy: 3-year experience at a tertiary care center with 54 children. Turk J Pediatr 2011; 53: 537-540.

The aim of this study was to evaluate the indications, complications and outcomes of pediatric tracheotomies at a tertiary care center. Data were obtained retrospectively from 54 patients who underwent tracheotomy from July 2007 to May 2010. Over the three-year period, 54 tracheotomies were performed. Thirty-two patients (59.3%) were male and 22 (40.7%) were female. The mean and median ages of the patients were 54 and 14 months (6 days-17 years), respectively. Twenty-six patients (48.1%) were under 1 year of age. The most common indication for tracheotomy was prolonged intubation (87%), followed by upper airway obstruction (13%). Five patients (9.2%) underwent tracheotomy under semiurgent settings. The overall complication rate was 29.6% (16/54). Early complications occurred in 7 patients (13%), including accidental decannulation in 2 patients, subcutaneous emphysema in 4 patients and hemorrhage in 1 patient. Late complications occurred in 9 patients (16.7%) (stomal granulation in 7 patients and stomal infection in 2 patients). Eight patients (14.8%) were decannulated successfully. No tracheotomy-related deaths occurred, with an overall mortality rate of 27.7% (15/54). Pediatric tracheotomy is a relatively safe procedure with a low incidence of procedure-related morbidities. The indication for the majority of the procedures was prolonged intubation (87%). The lower decannulation rate is related to the higher percentage of patients needing assisted ventilation and the relatively short follow-up period.

Key words: pediatric tracheotomy, indications, complications, outcome.

The history of tracheotomy, a well-known procedure, dates back to ancient Greece. The total number of pediatric tracheotomies and their indications have changed considerably in the last 3-4 decades[1-6]. Tracheotomy is a potentially life-saving procedure, but reports in the literature suggest that the risks associated with the procedure are significantly higher in children than in adults[4-12]. During the 1970s and 1980s, the most common indication for tracheotomy in children was acute inflammatory airway obstructions, such as acute epiglottitis, croup and diphtheria[3-6,12-19]. Evolution of modern techniques in neonatal and pediatric intensive care units combined with introduction of vaccines against Haemophilus influenzae and Corynebacterium diphtheriae has turned long-term intubation and its relevant sequelae into the most common indications for pediatric tracheotomy[3-6,8,13,20]. The goal of this study was to assess the indications and complications of pediatric tracheotomies performed at Ondokuz Mayıs University Hospital from July 2007 to May 2010.

Material and Methods

The study was approved by the Ethics Committee of Ondokuz Mayıs University Medical Center (2010/65). Our institutional data revealed that 54 children aged under 18 years underwent tracheotomy between July 2007 and May 2010 (Fig. 1). Patient charts were analyzed with respect to age, sex, primary diagnoses and indications mandating tracheotomy, and early and late complications. Early complications were defined as those experienced intraoperatively or within the

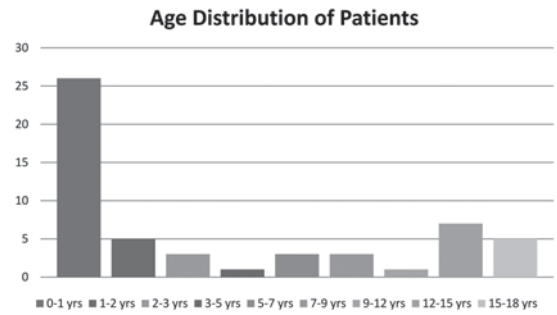

Figure 1. Age Distribution of Patients

first week following the procedure[1,5,8,15,19]. Late complications included those experienced after the first week[1,5,8,15,19]. All tracheotomies were performed under general anesthesia after receiving informed consent of the parents. Ninety-four percent (51/54) of the procedures were performed by the same pediatric otolaryngologist (S.A.). Five patients (9.2%) underwent tracheotomies under semiurgent settings. The standard tracheotomy procedure at our clinic starts with supine positioning of the child with a rolled-up towel placed under the shoulders. Sternal notch, hyoid bone, cricoid cartilage, midline chin, and a vertical skin incision line below the cricoid cartilage are marked, and local anesthetic is infiltrated on the skin and subcutaneous tissue of the incision line. Following the vertical skin incision, the subcutaneous fat is debulked. The dissection proceeds in the midline, dividing the strap muscles, and the thyroid isthmus is exposed and retracted. The anterior tracheal wall, the cricoid cartilage and the tracheal rings are identified. The cricoid cartilage is suspended with a hook, stay sutures are placed on either side of the proposed tracheal incision, and the trachea is incised vertically through second - third and fourth rings between the stay sutures. A tracheotomy tube is inserted and lung ventilation is confirmed by the anesthesia team. Finally, stay sutures are taped on the chest and the tube is tied with the neck in slight flexed position.

Results

A total of 54 pediatric tracheotomies were performed over the three-year period. Thirty-two patients (59.3%) were male and 22 (40.7%) were female. The mean and median ages of the patients were 54 and 14 months (6 days-17 years), respectively. Twenty-six patients (48.1%) were under 1 year of age. The most common indication for tracheotomy was prolonged intubation (47/50; 87%), with the remaining patients (7/54; 13%) requiring tracheotomy for upper airway obstruction (Table I). Complications were encountered in 29.6% (16/54) of the patients (Table II). Two accidental decannulations and 1 minor hemorrhage occurred in the first week but they were managed successfully with no mortality. Decannulation was achieved in 8 patients (14.8%). The overall mortality rate was 27.7% (15/54) due to the primary diseases with no tracheotomy-related deaths.

Discussion

Prolonged ventilation was the main indication (87%) for pediatric tracheotomy at Ondokuz Mayıs University Hospital, whereas only 13% of the indications consisted of upper airway obstruction-related disorders. Although different studies report heterogeneous results, the main indication has changed considerably from airway obstruction to prolonged intubation for the last three decades with the introduction of endotracheal intubation, H. influenzae vaccine and prolonged intensive care unit (ICU) care[1,3-6,13]. Butnaru et al.[13] and Mahadevan et al.[4] reported that prolonged intubation was the main indication in 57% and 70% of their series, respectively. Our study has the highest rate (at 87%) of prolonged intubation as the main indication for pediatric tracheotomy reported thus far. This result can be attributed to the period (2007-2010) in which our data was collected and the number and characteristics of

Table I. Tracheotomy Indications

Indications	Patients
Prolonged intubation	47 (87%)
Neurological	16
Muscular	13
Infection-sepsis	9
Tumor	2
Others	7
Upper airway obstruction	7 (13%)
Pierre-Robin sequence	3
Head and neck trauma	1
Gunshot wound	1
Infection	2
Total	54 (100%)

Table II. Tracheotomy Complications

Complications	Patients
Early postoperative	7 (13%)
Subcutaneous emphysema	4
Accidental decannulation	2
Hemorrhage	1
Late postoperative	9 (16.7%)
Stomal granulation	7
Stomal infection	2
Total	16/54 (29.6%)

the non-ICU patients seen in our institution; the more recent the period of time, the higher the percentage of prolonged intubation as the main indication. The technique of pediatric tracheotomy has also changed over the decades. Many surgeons prefer a vertical midline incision to the trachea to excision of a cartilage window. We also prefer a vertical midline incision to the trachea, which is thought to be associated with a lower risk of stenosis. Pediatric tracheotomy is associated with several complications and the complication rates in children are higher than in adults[1,2,4,6-10,12,14-16,21,22]. Our overall complication rate was 29.6% (16/54), which is comparable with the results ranging from 19% to 51% reported in other studies[1,4-7,10,14]. We experienced two accidental decannulations that were promptly managed by the ICU team and a minor hemorrhage in the early postoperative period. Stomal granulation was the most common late postoperative complication, encountered in 7 (13%) patients. There was no tracheotomy-related mortality. Our findings suggest that pediatric tracheotomy is a safe procedure in our hands with an acceptable rate of morbidity and no mortality, especially when comparing it with a group of patients who were kept intubated without a tracheotomy, showing a very high incidence of subglottic stenosis (in almost every case), which necessitated multiple surgeries and caused significant morbidity. Eight patients (14.8%) were decannulated successfully. Decannulation rates ranging from 18.7% to 92% were reported by several authors[1,5,8,10,17]. Our low decannulation rate (14.8%) was associated with the high percentage of patients in the prolonged intubation group and the short follow-up period. Children needing tracheotomy after prolonged intubation could not be decannulated, usually due to either the primary disease or severe subglottic stenosis necessitating multiple surgical procedures. Finally, we experienced no tracheotomy-related deaths, with an overall mortality rate of 27.7%.

In conclusion, our series revealed the highest percentage of children (at 87%) in the prolonged intubation group reported in the literature. We experienced an acceptable incidence of complications with no procedure-related mortality. We reported a low decannulation rate due to the high percentage of patients dependent on assisted ventilation and the short follow-up period. Based on our experience, pediatric tracheotomy is a relatively safe procedure in experienced hands with potential significant complications.

REFERENCES

1. Ang AH, Chua DY, Pang KP, Tan HK. Pediatric tracheotomies in an Asian population: the Singapore experience. Otolaryngol Head Neck Surg 2005; 133: 246-250.
2. Goldenberg D, Ari EG, Golz A, Danino J, Netzer A, Joachims HZ. Tracheotomy complications: a retrospective study of 1130 cases. Otolaryngol Head Neck Surg 2000; 123: 495-500.
3. Hadfield PJ, Lloyd-Faulconbridge RV, Almeyda J, Albert DM, Bailey CM. The changing indications for paediatric tracheostomy. Int J Pediatr Otorhinolaryngol 2003; 67: 7-10.
4. Mahadevan M, Barber C, Salkeld L, Douglas G, Mills N. Pediatric tracheotomy: 17 year review. Int J Pediatr Otorhinolaryngol 2007; 71: 1829-1835.
5. Ozmen S, Ozmen OA, Unal OF. Pediatric tracheotomies: a 37-year experience in 282 children. Int J Pediatr Otorhinolaryngol 2009; 73: 959-961.
6. Parrilla C, Scarano E, Guidi ML, Galli J, Paludetti G. Current trends in paediatric tracheostomies. Int J Pediatr Otorhinolaryngol 2007; 71: 1563-1567.
7. Carr MM, Poje CP, Kingston L, Kielma D, Heard C. Complications in pediatric tracheostomies. Laryngoscope 2001; 111: 1925-1928.
8. Donnelly MJ, Lacey PD, Maguire AJ. A twenty year (1971-1990) review of tracheostomies in a major paediatric hospital. Int J Pediatr Otorhinolaryngol 1996; 35: 1-9.
9. Gaudet PT, Peerless A, Sasaki CT, Kirchner JA. Pediatric tracheostomy and associated complications. Laryngoscope 1978; 88: 1633-1641.
10. Midwinter KI, Carrie S, Bull PD. Paediatric tracheostomy: Sheffield experience 1979-1999. J Laryngol Otol 2002; 116: 532-535.
11. Schlessel JS, Harper RG, Rappa H, Kenigsberg K, Khanna S. Tracheostomy: acute and long-term mortality and morbidity in very low birth weight premature infants. J Pediatr Surg 1993; 28: 873-876.

12. Wetmore RF, Handler SD, Potsic WP. Pediatric tracheostomy. Experience during the past decade. Ann Otol Rhinol Laryngol 1982; 91: 628-632.
13. Butnaru CS, Colreavy MP, Ayari S, Froehlich P. Tracheotomy in children: evolution in indications. Int J Pediatr Otorhinolaryngol 2006; 70: 115-119.
14. Carron JD, Derkay CS, Strope GL, Nosonchuk JE, Darrow DH. Pediatric tracheotomies: changing indications and outcomes. Laryngoscope 2000; 110: 1099-1104.
15. Crysdale WS, Feldman RI, Naito K. Tracheotomies: a 10-year experience in 319 children. Ann Otol Rhinol Laryngol 1988; 97: 439-443.
16. Kremer B, Botos-Kremer AI, Eckel HE, Schlondorff G. Indications, complications, and surgical techniques for pediatric tracheostomies--an update. J Pediatr Surg 2002; 37: 1556-1562.
17. Prescott CA, Vanlierde MJ. Tracheostomy in children--the Red Cross War Memorial Children's Hospital experience 1980-1985. Int J Pediatr Otorhinolaryngol 1989; 17: 97-107.
18. Rozsasi A, Kuhnemann S, Gronau S, Keck T. A single-center 6-year experience with two types of pediatric tracheostomy. Int J Pediatr Otorhinolaryngol 2005; 69: 607-613.
19. Wetmore RF, Marsh RR, Thompson ME, Tom LW. Pediatric tracheostomy: a changing procedure? Ann Otol Rhinol Laryngol 1999; 108: 695-699.
20. Waddell A, Appleford R, Dunning C, Papsin BC, Bailey CM. The Great Ormond Street protocol for ward decannulation of children with tracheostomy: increasing safety and decreasing cost. Int J Pediatr Otorhinolaryngol 1997; 39: 111-118.
21. Joseph HT, Jani P, Preece JM, Bailey CM, Evans JN. Paediatric tracheostomy: persistent tracheo-cutaneous fistula following decannulation. Int J Pediatr Otorhinolaryngol 1991; 22: 231-236.
22. Waki EY, Madgy DN, Zablocki H, Belenky WM, Hotaling AJ. An analysis of the inferior based tracheal flap for pediatric tracheotomy. Int J Pediatr Otorhinolaryngol 1993; 27: 47-54.